

REMARKS

Claims 16-24 and 37-39 are pending in this application.

Rejections under 35 U.S.C. § 103

Claim 16 was rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent 6,337,163 to Sato in view of U.S. Patent 6,255,022 to Young et al. and further in view of U.S. Patent 6,379,869 to Schroeder et al. As will be explained below, Sato does not teach or disclose each feature of claim 16.

As acknowledged by the Examiner Sato does not teach or disclose the features of 1) providing a substrate with a developed silicon-containing photoresist layer disposed over a non-silicon containing photoresist layer and 2) exposing the substrate and the developed photoresist layer to an ultraviolet (UV) light.

The Examiner continues to assert that Figures 1C and 1D of Sato to come to the conclusion that the electron beam organosilicon regions have a greater resistance to subsequent etching than the non-organosilicon resist. Applicants again respectfully submit that this conclusion has no support in the specification of the Sato reference. Sato specifies that both are equally excellent (See column 102 lines 11-22). Moreover, the specification goes on to state that the organosilicon layer defined as underlying layer 12 is highly etchable as compared to both the resist layer 13 and the exposure region 16, thus enabling the excellent anisotropic etching (See column 102, lines 16-30). Furthermore,

the silicon oxide/carbide like film results from exposure of the underlying film to a charged beam, not ultraviolet light. Additionally, the charged beam is applied to define a pattern on the underlying film that is subsequently developed. The Examiner is ignoring that Sato requires that the underlying film 12 is limited to an organosilicon compound (See column 99, line 32 through column 100, line 36). This is due to this first embodiment requiring a material whose etching rate would be lowered by the irradiation of a charged beam (See column 5, lines 53-62). Thus, the electron beam exposure results in the conversion of the organosilicon compound to a silicon oxide/carbide like film (See column 5, lines 64-67). Moreover, the first embodiment uses UV light to develop the photoresist mask (See column 97, lines 43-48). The exposed substrate is then baked and developed.

The Examiner further asserts that Example 5 provides a potential use for a non-organosilicon underlayer in a similar process that involves similar patterning of an overlying resist before etching an underlying layer. Applicants respectfully traverse this characterization of the second embodiment. As depicted in Figures 5A-5E, the second embodiment defines a first resist pattern for a top resist layer, determines the position of the first resist pattern and then defines a second resist pattern for the same top resist layer. The first resist pattern is defined through exposure to an electron beam and then developed, and the second resist pattern is defined through exposure to a KrF excimer laser. This second pattern is then developed by baking and application of a developing solution (See column 107, line 56 through column 108, line 2). Thus, Example 5 provides for defining a pattern on a top resist layer through an electron beam first and then through UV radiation. After each exposure the resist is developed. The Examiner

refers to the BARC layer as a non-organosilicon underlayer over which an organosilicon layer is defined. The Applicants respectfully submit that nowhere does Sato define the composition of the BARC layer. Accordingly, there is no support for the Examiner to equate the BARC layer to a non-organosilicon layer as the BARC layer may be an inorganic composition. Furthermore, a BARC layer is not a photoresist and does not function as a photoresist. The present invention, as claimed, defines a developed silicon-containing photoresist layer over a non-silicon containing photoresist layer. The developed photoresist layer is then exposed to UV light to convert a top portion of the developed silicon containing photoresist. Thus, the process defined by Sato in Example 5 is not similar to the claimed invention as nowhere is it mentioned to apply UV to a developed resist. Accordingly, this example does not lay out a potential use for a non-organosilicon underlayer in a similar process.

To establish a *prima facie* case of obviousness, there must be some suggestion or motivation, either in the reference or in the knowledge generally available to one having ordinary skill in the art, to modify the reference. As discussed below, the Examiner has not established a *prima facie* case of obviousness because one having ordinary skill in the art would not have modified the reference in the manner proposed and the references when combined do not include all of the features of claim 16.

Specifically, there is no motivation to modify the reference as suggested by the Examiner. As discussed above Sato requires the under layer to be a material whose etching rate would be lowered by the irradiation of a charged beam (See column 5, lines 53-62). Thus, the electron beam exposure results in the conversion of the organosilicon

compound to a silicon oxide/carbide like film (See column 5, lines 64-67). Applicants assert that modifying Sato in view of Young, as suggested by the Examiner, ignores the teaching of Sato. Furthermore, the Examiner asserts that the hardened organosilicon photoresist (having a top portion converted to a silicon oxide/carbide film) is expected to provide greater etching resistance than the non-organosilicon resist. First of all, as mentioned above there is no basis for asserting the silicon oxide/carbide film has a greater etching resistance than the non-organosilicon resist. Secondly, the silicon oxide/carbide film is a result of the charged beam being applied to the undeveloped photoresist and not the UV light being applied to the developed photoresist. Young uses UV light to develop the top photoresist and does not teach applying UV light to a developed photoresist.

The Examiner further asserts that it would have been obvious to develop the top portion of a silicon containing resist as taught by Schroeder to convert the to a hardened layer to improve etching resistance. Schroeder teaches applying UV light to deprotect active sites so that the active sites may be silylated. Nowhere does Schroeder teach applying UV light to a developed photoresist. Thus, even if the references cited by the Examiner are combined, the result would not include all the claimed features of claim 16. As discussed above, Sato fails to teach or disclose the feature of a substrate with a developed silicon-containing photoresist layer disposed over a non-silicon containing photoresist layer or the feature of exposing the substrate and the developed photoresist layer to an ultraviolet (UV) light. Young and Schroeder fail to provide any motivation to modify Sato.

Claim 18 depends from claim 16 and as such includes all of the features of claim 16. As mentioned above, Sato fails to teach or suggest the feature of a substrate with a developed silicon-containing photoresist layer disposed over a non-silicon containing photoresist layer or the feature of exposing the substrate and the developed photoresist layer to an ultraviolet (UV) light. Tsai is silent to both of the aforementioned features, therefore, Tsai fails to cure the deficiencies of Sato, Young and Schroeder.

Claims 19-23 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent 6,337,163 to Sato in view of U.S. Patent 6,255,022 to Young et al. and further in view of U.S. Patent 6,379,869 to Schroeder et al. in view of U.S. Patent 5,899,748 to Tsai et al., further in view of U.S. Patent 5,123,998 to Kishimura, further in view of U.S. Patent 6,479,820 to Singh et al. further in view of U.S. Patent 4,980,563 to George et al. Applicants respectfully submit the Kishimura, Singh, and George references do nothing to cure the deficiencies of the Sato, Young and Schroeder references discussed above. Accordingly, claims 19-23 are patentable over the cited art for at least the reasons stated above.

Claim 24 was rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent 6,337,163 to Sato in view of U.S. Patent 6,255,022 to Young et al. and further in view of U.S. Patent 6,379,869 to Schroeder et al. in view of U.S. Patent 6,451,512 to Rangarajan et al. Rangarajan teaches post development photoresist silylation of a photoresist under UV light. Applicants respectfully submit the Rangarajan reference does nothing to cure the deficiencies of the Sato, Young and Schroeder references discussed above. Furthermore, the Examiner states that it would have been obvious to

combine the references to harden 2% to 100% of the developed photoresist layer to improve selectivity. Applicants respectfully submit that there is no motivation to combine the references as proposed by the Examiner. Sato teaches an underlying organosilicon film. As the underlying film has a silicon component, there is no need to perform post development silylation. Furthermore, silylation of the underlying layer would cause the entire layer to become hardened, thereby, preventing the formation of the pattern under Sato. Thus, the combination as proposed by the Examiner would render Sato unsatisfactory for its intended purposes in that a subsequent pattern would not be able to be developed.

Claims 37-39 have been added. Claim 37 includes the features of applying a first non-silicon containing photoresist layer over a substrate; applying a second silicon-containing photoresist layer over the first photoresist layer; and generating ultraviolet (UV) light from the plasma, thereby exposing the developed second photoresist layer and the exposed first non-silicon containing photoresist layer to plasma generated UV light. For at least the reasons stated above with reference to claim 16, the Applicants respectfully submit that claim 37 is not taught or disclosed by the cited art. As claims 38 and 39 depend from claim 37, claims 38 and 39 are patentable over the combination of Sato, Young, Schroeder, and Tsai.

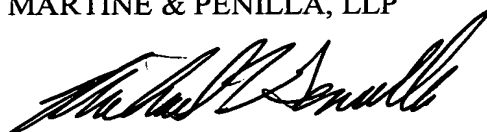
In view of the foregoing, Applicants respectfully submit that all of the pending claims are in condition for allowance. A notice of allowance is respectfully requested. In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at (408) 749-6900 x6921. If any fees are due in

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connection with the filing of this paper, then the Commissioner is authorized to charge such fees to Deposit Account No. 50-0805 (Order No. LAM2P257). A copy of the transmittal is enclosed for this purpose.

Respectfully submitted,

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A handwritten signature in black ink, appearing to read "Michael L. Gencarella", written in a cursive style.

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